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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Hua Chung

APPM/6303/CPI/COPPER/PJS

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Patent Counsel
Applied Materials, Inc.
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EXAMINER

STOUFFER, KELLY M

ART UNIT

PAPER NUMBER

1762

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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2 MONTHS

01/25/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.



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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/965,370
Filing Date: September 26, 2001
Appellant(s): CHUNG ET AL.

MAILED
JAN 25 2007
GROUP 1700

Keith M. Tackett
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 9 November 2006 appealing from the Office action mailed 28 November 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be reviewed on Appeal

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner. The 35 USC 103 (a) rejection of claims 42, 44-52, 60-62 and 64-66 under Lopatin et al. (US Patent number 6368954) in view of Lopatin et al. (US Patent number 6174799) and the 35 USC 103 (a) rejection of claims 42, 44-52, 60-62 and 64-66 under Lopatin et al. (US Patent number 6368954) in view of Lopatin et al. (US Patent number 6174799) and in further view of Tsai et al. (US Patent number 6309964).

NEW GROUND(S) OF REJECTION

35 USC 103 (a) rejection of claims 42, 44-52, 60-62 and 64-66 under Lopatin et al. (US Patent number 6368954) in view of Lopatin et al. (US Patent number 6174799) and in further view of Kobayashi et al. (US Patent number 5023698) and 35 USC 103 (a) rejection of claims 42, 44-52, 60-62 and 64-66 under Lopatin et al. (US Patent number 6368954) in view of Lopatin et al. (US Patent number 6174799) and in further view of Tsai et al. (US Patent number 6309964) and Kobayashi et al. (US Patent number 5023698).

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,368,954 B1	LOPATIN ET AL.	04-2002
6,174,799 B1	LOPATIN ET AL.	01-2001
6,309,964 B1	TSAI ET AL.	10-2001
5,023,698	KOBAYASHI ET AL.	06-1991

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-7, 9-31, 33-41, 53-59, 63, and 67-69 are rejected under 35 U.S.C.

103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1).

Lopatin ('954) teaches a process of forming a barrier layer of tantalum, tungsten, or titanium, and nitrides or silicides thereof (column 5, lines 19-25). The barrier layer is formed by ALD to a thickness of 20-300 angstroms (column 5, lines 29-31). Two copper seed layers are taught and are formed by ALE or CVD (column 5, line 40 - column 6, line 54). The bulk copper layer is deposited by CVD (column 6, lines 55-67). The reference is silent to the seed layer comprising other metals besides copper.

However, Lopatin ('799) teaches that copper seed layers alloyed with aluminum or magnesium decreases electro-migration (abstract; column 3, lines 1-15). A nitrogen grading is additionally responsible for increased adhesion (abstract; column 3, lines 1-15). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the constituents of the seed layer of Lopatin ('799) in the process taught by Lopatin ('954). By doing so, one would reap the benefits of the bulk copper layer having better adhesion to the barrier layer and decreased electro-migration.

As to claims 31, 42, and 44-69, the claims read "less than about 20 angstroms" (emphasis added). It is the position of the examiner that 20.00001 is "about 20

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angstroms". Since 20 is less than 20.00001, the reference anticipates "less than about 20 angstroms".

Claims 31, 32, 53-59, 63, and 67-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1), as applied to the claims above, and further in view of Tsai et al. (US 6,309,964 B1).

Lopatin, in view of Lopatin, teach the limitations above. In the event the applicant does not agree with the examiner's position that 20 angstroms reads on "less than about 20 angstroms", the examiner has provided Tsai. Tsai teaches barrier layers of the same material being effective at a thickness of 10 angstroms (column 3, lines 40-46). It would be apparent to one of ordinary skill that this would use less material and/or would decrease the size of the semiconductor. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use a thickness of 10 angstroms for the barrier layer in the process taught by Lopatin. By doing so, one would reap the benefits of using less material and/or creating a smaller semiconductor, while still producing an effective barrier layer. This also reads on claim 32.

NEW GROUND(S) OF REJECTION

Claims 42, 44-52, 60-62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US Patent number 6368954) in view of Lopatin et al.

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(US Patent number 6174799) as applied above, and further in view of Kobayashi et al. (US Patent number 5023698).

Lopatin et al. (US Patent number 6368954) and Lopatin et al. (US Patent number 6174799) include the limitations of claims 42, 44-52, 60-62 as discussed above and Lopatin et al. ('799) includes a desire to reduce electro-migration by adding another metal such as aluminum in the copper seed layer (column 2 lines 34-38 and column 3 lines 7-10). The two references do not include claimed atomic ratios of aluminum contained in the copper layer. Kobayashi et al. teaches that providing Al in the claimed atomic ratios (when calculated from the weight percentages using atomic weights) in an alloy with copper improves electro-migration resistance in a wiring layer, hence it would be obvious to use the claimed ratios of Al in the CuAl seed layer with a reasonable expectation of reducing electro-migration. (column 3 lines 50-59 and column 4 lines 1-14).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lopatin et al. (US Patent number 6368954) and Lopatin et al. (US Patent number 6174799) to include the claimed atomic ratios for aluminum in the copper layer as taught by Kobayashi et al. in order to improve electro-migration resistance.

Claims 42, 44-52, 60-62 and 64-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US

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6,174,799 B1), as applied to the claims above, and further in view of Tsai et al. (US 6,309,964 B1) and Kobayashi et al. (US Patent number 5023698).

Lopatin et al. (US Patent number 6368954), Lopatin et al. (US Patent number 6174799), and Tsai et al. include the limitations of claims 42, 44-52, 60-62 as discussed above except for the claimed atomic ratios of aluminum contained in the copper layer. Kobayashi et al. teaches using the claimed atomic ratios (when calculated from the weight percentages using atomic weights) to improve electro-migration resistance (column 3 lines 50-59 and column 4 lines 1-14).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lopatin et al. (US Patent number 6368954), Lopatin et al. (US Patent number 6174799), and Tsai et al. to include the claimed atomic ratios for aluminum in the copper layer as taught by Kobayashi et al. in order to improve electro-migration resistance.

(10) Response to Argument

The applicant's arguments regarding the 35 U.S.C. 103(a) rejections of claims 1-7, 9-31, 33-41, 53-59, 63, and 67-69 under Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1) are not convincing. The applicant argues that the combined references do not teach the limitations of claims 1-7, 9-31, 33-41, 53-59, 63, and 67-69 and further that one of ordinary skill in the art would not be motivated to combine these two references. As is discussed above, Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1) together meet the limitations of claims 1-7

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and 9-10. Also, as stated above, Lopatin ('799) teaches that copper seed layers alloyed with aluminum or magnesium decreases electro-migration (abstract; column 3, lines 1-15). A nitrogen grading is additionally responsible for increased adhesion (abstract; column 3, lines 1-15). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the constituents of the seed layer of Lopatin ('799) in the process taught by Lopatin ('954). By doing so, one would reap the benefits of the bulk copper layer having better adhesion to the barrier layer and decreased electro-migration.

With regard to the 35 U.S.C. 103(a) rejection of claims 42, 44-52, 60-62 under Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1), the applicant's arguments are moot considering the new grounds of rejection presented above.

The applicant's arguments regarding the 35 U.S.C. 103(a) rejection of claims 31, 32, 53-59, 63, and 67-69 under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1), and further in view of Tsai et al. (US 6,309,964 B1) are not convincing. The applicant similarly argues that the combined references do not teach the limitations of claims 1-7, 9-31, 33-41, 53-59, 63, and 67-69 and further that one of ordinary skill in the art would not be motivated to combine Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1). The examiner respectfully disagrees for the reasons already stated above.

With regard to the 35 U.S.C. 103(a) rejection of claims 42, 44-52, 60-62 under Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1), and further

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in view of Tsai et al. (US 6,309,964 B1), the applicant's arguments that the cited art does not teach the claim limitations and that one would not be motivated combined the references are substantially not persuasive for the reasons set forth above, with the exception of the argument that the references do not teach the limitation of the claimed ratios of Al to Cu in the alloy seed layer. However, these claims are obvious for the reasons described in the new grounds of rejection set forth above.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

This examiner's answer contains a new ground of rejection set forth in section (9) above. Accordingly, appellant must within **TWO MONTHS** from the date of this answer exercise one of the following two options to avoid *sua sponte* **dismissal of the appeal** as to the claims subject to the new ground of rejection:

(1) **Reopen prosecution.** Request that prosecution be reopened before the primary examiner by filing a reply under 37 CFR 1.111 with or without amendment, affidavit or other evidence. Any amendment, affidavit or other evidence must be relevant to the new grounds of rejection. A request that complies with 37 CFR

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41.39(b)(1) will be entered and considered. Any request that prosecution be reopened will be treated as a request to withdraw the appeal.

(2) **Maintain appeal.** Request that the appeal be maintained by filing a reply brief as set forth in 37 CFR 41.41. Such a reply brief must address each new ground of rejection as set forth in 37 CFR 41.37(c)(1)(vii) and should be in compliance with the other requirements of 37 CFR 41.37(c). If a reply brief filed pursuant to 37 CFR 41.39(b)(2) is accompanied by any amendment, affidavit or other evidence, it shall be treated as a request that prosecution be reopened before the primary examiner under 37 CFR 41.39(b)(1).

Extensions of time under 37 CFR 1.136(a) are not applicable to the TWO MONTH time period set forth above. See 37 CFR 1.136(b) for extensions of time to reply for patent applications and 37 CFR 1.550(c) for extensions of time to reply for ex parte reexamination proceedings.

Respectfully submitted,

Kelly M. Stouffer



Examiner, Art Unit 1762

A Technology Center Director or designee must personally approve the new ground(s) of rejection set forth in section (9) above by signing below:

Gregory Mills



GREGORY MILLS
QUALITY ASSURANCE SPECIALIST

Application/Control Number: 09/965,370

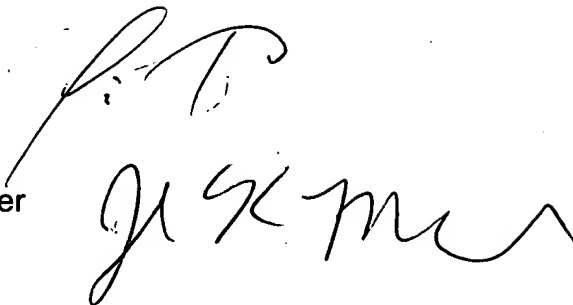
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Conferees:

Timothy Meeks

Jennifer Michener

Handwritten signatures of Timothy Meeks and Jennifer Michener. Timothy Meeks' signature is written above Jennifer Michener's signature.